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By L. F. Ayson

Chief Inspector of Fisheries for New Zealand



Paper presented before the Fourth International Fishery Congress
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INTRODUCTION OF AMERICAN FISHES INTO NEW ZEALAND.

By L. F. AYSON,
Chief Inspector of Fisheries for New Zealand.

At the commencement it is, I think, appropriate to say something about the geographical position and physical features of this little country in the far away South Pacific, which is doing much valuable work for its people by the introduction into its waters of a number of the best sport and commercial fishes from the Northern Hemisphere.

New Zealand, situated between latitudes 34 and 47 degrees south, in the Pacific Ocean, consists of three main islands, the total area of which is about 104,000 square miles. A large extent of the country is mountainous, particularly in the Middle Island, which is intersected along almost its entire length (about 500 miles) by a range of mountains known as the Southern Alps, the highest peak, Mount Cook (the Maori or native name is "Aorangi," meaning "cloud piercer"), being 12,400 feet. The summer snow line on these mountains is about 7,000 feet above sea level.

As would be expected from a country with such physical characteristics, New Zealand possesses a very fine system of rivers and lakes. In the South Island the larger rivers all originate among snow-clad mountains of hard rock formations; in a good many instances their tributaries flow into mountain lakes and from there down through the low country into the sea. Over 20 rivers, taking their rise among the glaciers of the Southern Alp range, flow down into the Pacific Ocean on either coast. In parts of the North Island the same formations prevail to a large extent, but many of the rivers run for the greater length of their course through low country.

This country, with its unique flora and fauna, has also the extraordinary peculiarity that with its magnificent water system it has no indigenous fresh-water fishes of any sporting or commercial value. Eels (*Anguilla australis*) are found everywhere, also a few inferior fishes, such as the kokopu (*Galaxias fasciatus*); but the only representative of the Salmonidæ is the little smelt (*Retropinna richardsoni*) and the native grayling (*Prototroctes oxyrhynchus*),

called by the natives "upokororo." This interesting fish, however, seems to be on the verge of extermination, owing to the introduction of trout into the rivers it inhabits, to mining, and to clearing of the vegetation from the banks of the rivers for farming purposes.

The early colonists who emigrated to New Zealand from Great Britain were very much surprised to find a country with such fine rivers, lakes, and streams, but with no fish of any value in them. In a few years the question of introducing some of the British Salmonidæ was considered, and in 1864 the matter assumed definite shape when the Otago Provincial Council took it up and voted a sum of money for the importation of Atlantic salmon eggs (*Salmo salar*), and in 1868 the first lot of English brown trout (*Salmo fario*) eggs arrived in the colony. Since that time the English brown trout and the Loch Leven trout (*Salmo levenensis*) have been successfully acclimatized, and the brown trout now abounds in many of the rivers, particularly those in the South Island.

Of American fishes the following species have been brought into New Zealand: Rainbow trout (*Salmo irideus*), eastern brook trout (*Salvelinus fontinalis*), whitefish (*Coregonus clupeiformis*), chinook salmon (*Oncorhynchus tshawytscha*), sockeye salmon (*O. nerka*), landlocked salmon (*Salmo sebago*), Mackinaw trout (*Cristivomer namaycush*), lake herring (*Argyrosomus artedi*), and catfish (*Ameiurus vulgaris*). Of these we have successfully acclimatized the rainbow trout, brook trout, and the catfish, and as the chinook and sockeye salmon have now returned from the sea to spawn three seasons in succession, I think that we can fairly claim that they are established as well.

The following account of the introduction of the fishes mentioned above may be of interest:

Rainbow trout.—Three consignments of eggs were obtained from California by the Auckland Acclimatization Society in 1883 and 1884. These, I believe, were the only rainbow eggs which have been brought to this country. A considerable percentage were lost on the voyage down, but sufficient were saved to provide a stock of brood fish for the hatcheries, and a number to plant in some of the northern rivers. It took some years to work up a stock of spawners at the hatcheries, and as the young fish were produced they were planted in streams all over the Auckland province. It is about fifteen years since rainbow trout commenced to be caught by anglers, and now they exist in immense numbers in almost all the rivers, lakes, and streams in that part of the country.

These fish grow to a great size in this country. While the most common weight caught by anglers is from 2 to 8 pounds, specimens are frequently taken ranging from 10 to 18 pounds, and occasionally over 20 pounds. On the walls of my office I have six mounted specimens taken in the spawning season from a stream flowing into Lake Tarawera; the smallest of these is 12 pounds and the largest 18 pounds. Heavier specimens could have been procured, but these

were chosen on account of their elegant shape. They are most plentiful in the streams flowing into and in Lakes Rotorua and Rotoiti. By angling (and anglers are restricted to 30 pounds weight a day) over 20 tons of trout have been taken out of these two small lakes this season. Rainbow-trout fishing has now become one of the chief attractions for tourists to the Rotorua district, and the value of this fish to the country, both for sport and food, is immense.

Eastern brook trout.—The first brook-trout eggs brought to this country were imported by a Mr. Johnson, of Christchurch, in the South Island, about 1882, and from Mr. Johnson's importation various acclimatization societies obtained eggs from which they subsequently raised stock fish for their hatcheries. From these hatcheries large numbers of young fish of various sizes have been planted in streams both in the north and south. They made a good showing in a few streams for a time, but since the introduction of the rainbow and English brown trout into these streams the brook trout in some instances have wholly disappeared and in others have been greatly reduced in numbers. Our people think highly of this beautiful fish and are much disappointed because better success has not attended the efforts made to thoroughly establish them in our waters.

Chinook salmon.—The first importation of eggs was made in 1875 and from that date to 1880 several shipments were made, some by the Government and some by acclimatization societies. On arrival the salmon eggs were parceled out to different acclimatization societies and the young fish when hatched were planted in rivers from the north of Auckland to the far south. Through want of experience, unsuitable water at the hatcheries, and planting the young fish in rivers when the conditions were entirely unsuitable for them, no results were obtained from these shipments.

In 1900 the government decided to make a vigorous and systematic effort to acclimatize this fish. A site for a salmon station was chosen on the Haketaramea River, a tributary stream of the Waitaki, and the erection of the hatching shed was commenced in November of that year. The government decided to confine its efforts to one of the rivers considered to be the most suitable for these fish, and the Waitaki was chosen, as in its general characteristics it bears a considerable resemblance to the rivers on the Pacific coast of America which the chinook salmon frequent in the spawning season.

In January, 1901, the first shipment of chinook eggs for the government salmon station arrived. They were supplied by the United States Bureau of Fisheries, from its station at Baird, California, on the McCloud River. The shipment came over in charge of Mr. G. H. Lambson, superintendent of the Baird station, and arrived in excellent condition.

From 1901 to 1907 five importations of eggs were made, invariably arriving in splendid condition, the loss in most of the shipments not amounting to more

than one-half per cent, i. e., 99 $\frac{1}{2}$ per cent of good eggs were unpacked into the hatching boxes at Hakataramea. The total number of eggs in the five shipments reached about 2,000,000, and from these fully 1,700,000 young fish have been turned out. They were planted at various ages from fry to 2-year-old fish, but about 90 per cent were planted just after the sac was absorbed.

Now, as regards the definite results obtained from the young salmon planted. In 1905 salmon were reported as having been caught by anglers in the tideway near the mouth of the Waitaki River, and a specimen of these fish was identified by the late Sir James Hector as a male of the genus *Oncorhynchus*. In May and June, 1906, salmon were found spawning in the Hakataramea River, and specimens were identified by Sir James Hector and myself as chinook. In April and May last year (1907) quite a run of salmon came up the Waitaki River and spawned in several of its main tributary rivers. In the Hakataramea from 300 to 400 salmon spawned in the 2 miles of river before it joins the Waitaki, and a number of these fish were caught and stripped and about 30,000 eggs put down to hatch. The eggs hatched out well, and a number of the young fish are now being reared at the salmon station for experimental purposes. This season the run of spawning salmon in the Waitaki is similar to last year as to quantity, but on an average the fish are considerably heavier, and they seem to have run higher up the main tributary rivers of the Waitaki. Several dead and "spent" fish measured from 3 feet to 3 feet 10 inches in length. Owing to floods when the best run was on, we were able to collect only about 50,000 eggs this season. From the knowledge now acquired with regard to the run of fish in rivers farther inland, arrangements will be made to collect eggs on several streams next season. A point which will be interesting to salmon authorities is that as far as we have gone we have had no "summer" run of salmon; they have always come in April, May, and June—months which correspond, as regards season, with November, December, and January in the northern hemisphere, and the months when the "winter" run of chinook salmon takes place in the Sacramento. Now, I understand that the five shipments of eggs imported to this country from 1900 to 1907 were all from "winter" run fish, and so far we have only had a "winter" run of spawning salmon here.

Sockeye salmon.—Only one importation of sockeye eggs was made to this country. A shipment of 300,000 was presented to the New Zealand government by the Canadian fisheries department in 1902. Most of the young fish were planted in streams flowing into Lake Ohau, a lake fed by rivers flowing down from the snowy Southern Alp Range. In 1905 and 1906 reports were received of salmon spawning in the rivers at the head of Lake Ohau, but we were not able to procure specimens until the "run" which took place in April last year.

The officer who visited the locality reported having seen a large number of dead salmon. He netted a number of fish and brought six specimens, the examination of which by experts proved them to be sockeye.

Whitefish.—The first shipment of eggs was brought from America in 1877, and from that year to 1904 several shipments were brought over. Owing to the want of expert attention on the voyage, these shipments generally arrived in indifferent condition, and as none of the hatcheries had proper appliances for hatching the eggs I am afraid that most of them were killed. In 1904 the New Zealand government determined to make a systematic effort to acclimatize this fish and erected hatcheries, equipped with the proper whitefish hatching jars, on Lakes Te Kapo and Kanieri. Four shipments of eggs were brought over from 1904 to 1907, and as they were carefully packed and selected for the journey and came over in charge of an expert they all arrived in perfect condition. The loss from the time they left the hatchery at Northville, Mich., until put in jars in the hatcheries in New Zealand was under 3 per cent. The total number of eggs in these four shipments was about 6,000,000. The young fish were all planted in the lakes as soon as the sac was absorbed. As there is no netting for fish in these lakes no reliable information has yet come to hand as to whether they have done well or not, but we intend to net them early in the summer this year, for the purpose of proving whether or not they have taken a hold there.

Landlocked salmon.—One shipment of the eggs of these fish was brought to this country in 1906 and arrived in good condition. A number of the young fish have been planted in one of our lakes, and some are now being reared at two hatcheries for the purpose of procuring eggs from them when they mature. There is little doubt but what a good many of our lakes should be suitable for this fish.

Mackinaw trout.—A shipment of Mackinaw eggs was brought over from America in 1906 and they hatched out well. The young fish were planted in lakes in Canterbury and the west coast of the South Island.

Catfish.—A number of these fish were brought over from America by Mr. T. Russell, of Auckland, in 1877. They were placed in St. Johns Lake and are reported as being numerous in that lake at the present time.

The value of the introduction of these foreign fresh-water fishes into New Zealand waters can not be estimated. Formerly it was a country whose rivers and lakes were devoid of fresh-water fish of any value, now they are teeming with fish of the finest quality for sport and food. All this has been attained partly by the perseverance of our own people and by the generous assistance given to our Government by the United States Bureau of Fisheries and its officers in supplying any fish eggs required.

DISCUSSION.

MR. H. STEPHENSON SMITH. I would like to add, with your permission, sir, as New Zealand is a country very remote from this, and as many, perhaps, of my hearers do not know much about its geographical and topographical features, that the country covers approximately 15° of latitude, almost due north and south. It has over 5,000 miles of seaboard; it is interspersed with water courses. In a large portion of that country you will find a mountain stream every mile. We have also some arterial rivers, running 400, 500, 600, and 700 miles, in some cases navigable short distances from the mouth, and they are all tidal rivers. The majority of the smaller streams which run into the eastern and western streams are not tidal rivers, but are fed by glaciers from the mountains. The whole seaboard is indented with bays and harbors, the rivers coming down on each side; and the lakes extend from one side of the islands to the other. Some of the rivers are of considerable size for a country of that extent; and we have chains of lakes running for hundreds and hundreds of miles.

It would seem to me, as a man who knows little about fish except to eat them, that that country should afford facilities for producing fish of the very best kind and of almost any quantity. It also seems to me that there is plenty of food for the fish. The surface of the lakes and streams is covered with flies and many varieties of little insects all the year around; and the rivers never run dry, but are everlasting streams, winter and summer. I thank you very much for your kind attention.

MR. JOHN W. TITCOMB. One thought suggests itself to me: The results from the acclimatization of the chinook salmon perhaps are the most remarkable thing in the paper; but it is said that the rainbow trout, so-called, which is so very generally distributed now in New Zealand, is not the rainbow trout (*Salmo iridens*), but the steelhead trout (*Salmo gairdneri*).

Prof. EDWARD E. PRINCE. My name was down, I believe, for a communication a day or two ago, but my engagements officially have been so very pressing that I have with difficulty arrived even at this late hour. If you will permit me, I wish to bring a fraternal message from Canada to this important gathering, and I take this first opportunity of doing so.

One important reason why I would like to say a few words in regard to Mr. Ayson's paper is because I have been personally interested in this work of Mr. Ayson in New Zealand. He has several times visited Canada, and I have spent a good deal of time with him on those visits. I arranged for supplies of salmon eggs to be shipped to that distant part of the world, and I have always felt, as every fish culturist on this continent has, a very warm regard for him and his fishery work.

To sum up the great success of these efforts in New Zealand: Its rivers correspond in many features with those of the Pacific coast; many of them are glacial and have abundance of snow water, and there are other features which Mr. Smith referred to in the few remarks he made which correspond to the waters on this continent. But it seems that on the whole the planting of salmon has not been so successful as the trout, and it has always seemed to me one reason was in the lack of proper feeding grounds. There may be abundant food for them in the streams where they were planted as fry, but when out at sea they are literally "at sea;" they do not know where to go to get the appropriate food

which the salmon gets in the sea. When the salmon get out to sea they do not apparently find their way back again. Whether they find feeding grounds I do not know. The conditions are not the same off the coasts in the seas of New Zealand as off our own coast or the coast of Europe. But the trout do not wander far on the coast, and numbers remain in the rivers and lakes. They have really succeeded marvelously, so that fish whose original parents were only one or two pounds when adult, now reach twenty or thirty pounds in New Zealand (which is a size that would be almost incredible had we not abundant proof of it) under the favorable conditions provided in antipodean waters.

I have had a communication from Mr. Ayson, jr., within the last few days, in which he expresses hope that the sockeye salmon will be a success. If so, and these Pacific sockeyes breed, then I think the trouble for New Zealand salmon is solved.

I have listened with great interest to this paper, and have only to apologize for troubling the meeting with these remarks at this late stage of the discussion.

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